BASIC INFORMATION

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BUILDING PANEL AND BUILDINGS MADE THEREFROM

Technical Field

The present invention relates to buildings and in particular to a building panel for use in constructing buildings.

Background Art

There is throughout the world a need for dwellings and other buildings that can be rapidly and cheaply constructed and there have been many proposals for constructing such buildings. However, generally, the quality of such buildings has been low and/or such buildings have not been as simple to construct as would be desirable.

It is well known to construct buildings by erecting a rigid structural framework, for example of steel girders, and to bolt prefabricated panels between the girders to provide the desired outer and inner walls. However, such buildings are expensive and time-consuming to erect. Alternatively, it is known to erect buildings and enclosures out of prefabricated load-bearing panels that are connected together to provide the desired outer walls of the buildings. However, buildings made in this way are not acceptable as dwelling because they do not meet the requirements of fire-resistance. The problem of making fire-resistant prefabricated panels is complicated if they bear substantial loads since the load tends to accelerate the disintegration of a panel when subject to fire.

It is also known to make building panels out of concrete containing a layer of insulating material. However such panels are heavy and difficult to transport and do not have good insulating properties. Also the insulation does not adhere to the concrete and so the panel is not a composite structure.

Disclosure of the Invention

According to the present invention, there is provided a rectilinear composite load-bearing building panel having a pair of opposed faces and a pair of opposed sides, the panel comprising a pair of spaced-apart rigid face sheets, a rigid insulating material sandwiched between, and adhering to, the face sheets, connecting means, which are preferably intermediate between the opposed sides, connecting the face sheets together to resist any relative movement between the face sheets both in the plane of the panel and out of the plane of the panel and wherein the opposed sides each have a profiled shape

for mating with a correspondingly profiled side of an adjacent panel and wherein the sides have means for securing them to sides of adjacent panels.

As used herein, the term "load-bearing panel" means a panel capable of withstanding compressive forces between the top and the bottom surfaces of at least 5 kN/m and preferably at least 10 kN/m: generally we aim at providing a panel capable of withstanding a compressive force of about 20 to 30 kN/m.

It is emphasized that the panel of the present invention is composite in nature, that is to say the face sheets adhere to, and therefore interact with, the insulating material to produce a panel having composite strength greater than that of the individual parts. This is to be distinguished from known case concrete building panels that includes an internal layer of insulating material since there is no structural interaction between the insulating material and the concrete and so such a panel acts as a laminar body and not a composite body. During a fire, the parts of the panel of the present invention also interact; for example, the insulating material isolates the connecting member from the high temperature of the fire while the connecting member prevents the face sheet next to the fire from buckling under the effect of the fire, thereby isolating the insulating material from the fire and also maintaining the structural integrity of the panel.

The face sheets are rigid boards (for example particle boards, cement particle boards, glass fibre reinforced cement boards, cellulose reinforced gypsum boards, crushed slate boards and resin boards; suitable boards are available under the trade names SUPALUX™, MONOLUX™, PANELCRETE™, VIROC™ and PYROC™); it is advantageous that the boards can take and retain fixings, for example nails, screws or staples; also the boards are preferably capable of being bonded to other panels or to other building elements or items by adhesive or foam injection. In addition to the above-mentioned materials, the face sheets can be made of wood, plastics material or metal. The face sheets are preferably thermally insulating and should not be made of readily combustible material. The face sheets may be treated with a fire-retardant paint to enhance the fire resistance of the panel, or may have a fire-retardant added to its composition.

The insulating material may be a rigid organic or inorganic foam, for example a foamed polyurethane or FOAMGLAS™ (which is a cellular inorganic material). The

panel is preferably made by foaming a polymer in situ between the face sheets and the materials used are advantageously such that the foam adheres directly to the board naturally so that no adhesive is required between the foam and the face sheets (as is the case of cement particle board and the polyurethane). In addition to any natural bond between the insulating material and the face sheets, the insulating material and the face sheets may be joined e.g. by adhesive or mechanically for example using a Velcro-type fastening arrangement.

The connecting means is preferably heat- and fire-resistant and it is most preferably metallic, although other materials, e.g. steel carbon fibre, fibre glass, glass, plastics, impregnated board or laminated timber, may be used. The connector must provide rigid connection between the face sheets that resists relative displacement of the face sheets both within the plane of the panel and out of the plane of the panel. The connector means is preferably elongate and more preferably vertically disposed within the panel. More particularly, the connecting means may be a stud of an "I", "C" or "Z" shaped-section; it may be solid, hollow, or of box or honeycomb construction. It need not be straight and, when viewed face-on, may be of "Z", "C", undulating, castellated or zig-zag shape. The connecting means plays an important function in maintaining the strength of the panel in the case of fire. It not only prevents the face-sheet delaminating from the insulating material and but also connects the two face sheets and so maintains the structural integrity of the panel which thus retains its composite structure and composite properties. Each panel may include more than one connecting member, the number of members in each panel depending on the size and the shape of the members, and the size of the panel. When the connecting means is in the form of a stud, there would generally be one, two or three such members. The connecting members may include openings either in the members themselves (by providing holes in the members) or between the members and the face sheets (for example by making the sides of the members abutting the face sheets as a castellated configuration) to assist the even distribution of foam to the panel.

The connecting means may themselves provide secondary load-bearing capacity, i.e. when the load-bearing capacity of a composite panel as a whole is somehow impaired, e.g. through fire. When this is the case, the connecting means can extend